CHRISTIAN PERSPECTIVE ON THE EXPLOSION OF KNOWLEDGE*

MARION A. MILCZEWSKI

Director, University of Washington Libraries, Seattle, Washington

Some months ago when I was asked if I would speak to this group I agreed to do so, even though with some hesitation. The title, "Christian Perspective on the Knowledge Explosion," seemed general enough to allow a good deal of latitude of interpretation and relevant enough to my interests as a librarian. Furthermore, you as an audience were then distant and out of focus, but now here you are - in sharp detail.

I could bounce figures at you for the rest of the morning to prove or to underscore the fact that there really has been an explosion of print. Whether it is an explosion of knowledge you as some of the primary consumers of print are in a better position to judge than I. However, I have been forced to conclude that there has been an explosion of knowledge, but I am not sure that the magnitude of the amount of print and that of knowledge are of the same order. Let me tease you with a few statements and figures about the explosion and refrain from overwhelming you with a flood of them.

There was a time when a single man could claim to be in possess-

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ion of all human knowledge and be reasonable sure that he would not be challenged.

Perhaps a century ago some men might reasonably claimed to have studied everything in a single science.

The proportion of the total realm of knowledge about which any man can claim to be fully informed continually grows smaller with the passage of time.

Now for some figures: Dr. D. J. de S. Price in his Science Since Babylon states, with little fear of contradiction, that the main forms of primary publication in science have been the proceedings of learned societies and journals. By 1800 nearly 100 had been published; by 1850, 1,000; by 1900, 10,000; by 1960, over 100,000; but of this last figure only about 25,000 were thought to be alive. Others have different estimates. Dr. G. Miles Conrad of Biological Abstracts estimated that in 1952 there were 50,000 scientific and technical journals in existence throughout the world, but nobody really knows because there are no comprehensive up-to-date lists that one can turn to. Charles Bourne of Stanford Research Institute puts the total figure in science as close to 30,000 journals, but further states that "more realistic estimates seem to point to a worldwide publication of about 15,000 significant journals with one million significant papers per year." Take your choice - but think BIG.

This is just in science and technology.

The Library of Congress attempted to make a systematic census of

world book production in all fields, but it was not kept up. However, the 1954 figures gave the following estimates for annual production:

Books	300,000
Periodicals	70,000
Newspapers	30,000
Maps	17,000

etc., etc.

It used to be that once books, and especially journals or newspapers, were out of print they were unavailable for later acquisition except first by reprinting and later by photography, but these were expensive means of reproduction. Micro-photography reduced the cost (and also the size of the image and introduced the need for expensive reading machines). Xerography has lowered the cost for a full size copy of a page to ten cents for a custom-made copy and about four to five cents a page for a similar copy where a microfilm is already available as the intermediary. But this relatively low cost has introduced another problem - what I call redundancy of paper. Cheaper methods of reproduction - just over the horizon - will only compound the problems.

Now I would like to quote from a recent article in International Science and Technology, written by the distinguished historian of science, Derek J. de Sola Price: "In this paper I shall deal with two types of statistical analysis; that in which an index is observed to vary with time, and that in which variation of an index is examined with some other factor or variable. In the first type one finds that almost any measure of science

shows it to grow exponentially with time; that is to say, at compound interest doubling (for most indices) every 10 - 15 years. Growth is regular, almost unaffected by recessions and wars, and where there exists a long enough time series one may show that growth has been proceeding thus for nearly three hundred years, ever since the middle of the seventeenth century when modern science emerged and the technique of the scientific paper was invented.

Roughly speaking, the numbers of scientists and scientific papers have multiplied by ten for every mere doubling of the population. For three centuries, science has been exploding into our civilization at a rate that makes the much-publicized population explosion look like a pop. Alive now are scientists produced over about 45 years - some three or four doubling periods. For every scientist who had lived before these were born there is another from the first doubling period, two from the second, four from the third, and perhaps eight from the fourth. Much as we miss Copernicus and Newton and Galileo, most of the fellows are still with us, for about 90% of all the scientists that have ever lived are alive now.

Although this point has been quoted frequently since I first computed it, the quoters have often attempted to show by it that modern science is burgeoning extraordinarily. Alas, from the very nature of the derivation it is apparent that this phenomenon of 90% immediacy is built in to the growth of science and has therefore been true from the very beginning. In the days of Maxwell, of Franklin, and perhaps even of Newton it was true that most scientist who had ever been were then alive."

I will not attempt to go into further detail of Dr. Price's argument except to say that in describing the statistical mechanics of exponential and logistic growth he applied them to a variety of different kinds of growth curves and concluded, "We may also assume that even quantities we cannot effectively measure...would be subject to the same sort of distribution if ever we could make an acceptable count." From this I conclude that the same general growth pattern should be discernible in other kinds of publication as in science. While no one has yet, as far as I know, applied these statistical measures to other literatures, in particular to the social sciences or belles lettres for example, I feel confident that we are dealing with relatively the same kind of growth in all areas of publication.

We may see a breakdown of the traditional methods of publishing and of soon going directly from the author's draft to computer and computer allied storage and machine retrieval both of bibliographic entry and text, but the exponential increase in the amount of informals to be handled is certain. There appears to be no end unless a slackening of exponential growth should occur or saturation is approached.

Now what is the "Christian Perspective" included in the subject of this brief presentation? It would be useful for one of our distinguished theologians to give us some insight into this matter. I am forced to provide only a relatively simple view which assumes that nothing special needs to be said about Christian vocation, that this underlying philosophy is understood and accepted.

Let me illustrate by this anecdote: Religion became the topic of conversation in a railroad smoking car after the clerically garbed Episcopalian Bishop George Craig Stwart joined the group of men. "Want to hear my religion, sir?" asked one man. "It's the Golden Rule - simply the Golden Rule." "Want to hear my astronomy, sir?" replied the Bishop. "Twinkle, twinkle, little star - simply twinkle, twinkle."

First let me state two beliefs.

One. There can be no Christian objection to the growth pattern evidenced in the knowledge explosion we are considering. In the first place, the growth we see results from a number of factors, such as

a population explosion,

an increase in the literate population,

an increase in the number of people with higher education, and

an increase in the number of people with a "higher" higher education.

In the second place, this pattern of growth has been in force since the creation of man and must, I believe, be considered one of the natural forces at work.

Two. The knowledge, the facts, the truth which are the fall-out products of the explosion are neither Christian nor non-Christian. But man's capacity to reason and the sense of obligation to objective, unprejudiced, factual truth are among his God-given gifts. The Christian scholar knows that he can neither reject scientific or humanistic truth nor agree that they represent all truth. Furthermore, he cannot stand aloof and fail, by standing aloof, to understand the significance of the knowledge that comes to him. He knows he must, with God's help, attempt to under-

stand; and with what insight he gets from the Lord, he must attempt to explain and through this process contribute his force to the explosion. Beyond this stance of the observer is that of participant, scientist, writer, artist, teacher in the search for and the transmission of truth which characterizes all of these.

Rather than objecting to the vast amount of knowledge available to him the Christian should rejoice, for in the main the knowledge explosion is the result of the search for truth wherever that search leads. The universe and the world and all that are in them were created by God and were not meant to be hidden and forbidden, but to be enjoyed and appreciated as God's creations. Not all searchers for truth are Christians, nor are all of them attempting to understand what has been created as God's handiwork. But the end result of the probing, the dissecting, the analyzing, the synthesizing, the comparing, provide the Christian with insights into the nature of God which his faith by itself cannot give him.

The nature of the explosion of knowledge is such that it is more difficult to get the kind of "complete" view of man, his world and the universe that early encyclopedic man had. Let me go back to the numbers game again and illustrate the problem from my viewpoint as a librarian.

The University of Washington is a society of scholars. Scholars are searchers for the truth. To provide this society with the printed materials it needs to feel "reasonably" certain of keeping up with the knowledge explosion, the University spends about $600,000 a year for books, journals, reports and all other kinds of print, near-print and microforms. This

amount brings us something like 20,000 current journals and other serial publications, 70,000 books and perhaps 5,000 microforms to add to the 1 1/3 million volumes we now have. In addition, we receive through agreements with governments and government agencies tons of publications issued by them in all parts of the globe. Furthermore, through the network of arrangements we have with other libraries in the United States and Canada, we have access to millions of additional volumes and almost all of the current journals published in almost any language of any significance. We probably should be spending closer to one million dollars annually for books and journals and adding about 150,000 volumes a year to make sure of receiving all the significant publications issued in the world and of filling in gaps - oceans would be a better word - needed to develop a first-rate collection for all of the subject areas in which the University has a research interest. The problems involved in an effort of that kind are almost beyond reasonable solution. The mass of material already coming in is just barely recordable. The articulation of the recording system with the problems in which researchers are interested in order for them to be able to find the materials they may need becomes more complex; first, because knowledge is more fractionated and more specific (general subject approaches to the mass is no longer productive); and second, because new concepts and new relationships are being constantly introduced. It is difficult enough to handle the volume we now get. I shudder to think what we will have to do - but do it we must - that is, provide six or eight or ten subject entries in our catalogs where we now

include three or four.

But the real burden is on the scholar who must somehow, through whatever aids are available to him in catalogs, indexes, abstracts, computer memories and his God-given resourcefulness, winnow the information that is awaiting his attention. It is no longer possible to be that general person "the scientist," for to keep up one would need to review something like a million scientific articles a year. Instead of understanding the whole he can but understand the fraction, but even in that fraction he should be able to see the handiwork of God.